



# FQD1N50 / FQU1N50

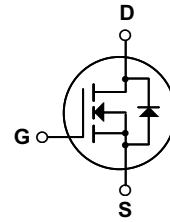
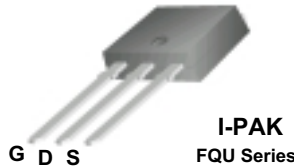
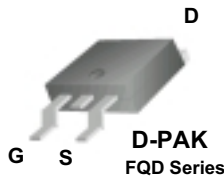
## 500V N-Channel MOSFET

### General Description

These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switch mode power supply, power factor correction, electronic lamp ballast based on half bridge.

### Features

- 1.1A, 500V,  $R_{DS(on)} = 9.0\Omega @ V_{GS} = 10V$
- Low gate charge ( typical 4.0 nC)
- Low Crss ( typical 3.0 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability
- RoHS Compliant



### Absolute Maximum Ratings T<sub>C</sub> = 25°C unless otherwise noted

Symbol	Parameter	FQD1N50 / FQU1N50	Units
V <sub>DSS</sub>	Drain-Source Voltage	500	V
I <sub>D</sub>	Drain Current - Continuous (T <sub>C</sub> = 25°C) - Continuous (T <sub>C</sub> = 100°C)	1.1	A
		0.7	A
I <sub>DM</sub>	Drain Current - Pulsed (Note 1)	4.4	A
V <sub>GSS</sub>	Gate-Source Voltage	± 30	V
E <sub>AS</sub>	Single Pulsed Avalanche Energy (Note 2)	80	mJ
I <sub>AR</sub>	Avalanche Current (Note 1)	1.1	A
E <sub>AR</sub>	Repetitive Avalanche Energy (Note 1)	2.5	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5	V/ns
P <sub>D</sub>	Power Dissipation (T <sub>A</sub> = 25°C) *	2.5	W
	Power Dissipation (T <sub>C</sub> = 25°C) - Derate above 25°C	25	W
		0.2	W/°C
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range	-55 to +150	°C
T <sub>L</sub>	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300	°C

### Thermal Characteristics

Symbol	Parameter	Typ	Max	Units
R <sub>θJC</sub>	Thermal Resistance, Junction-to-Case	--	5.0	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction-to-Ambient *	--	50	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction-to-Ambient	--	110	°C/W

\* When mounted on the minimum pad size recommended (PCB Mount)

## Electrical Characteristics T<sub>C</sub> = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	500	--	--	V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25°C	--	0.5	--	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 500 V, V <sub>GS</sub> = 0 V	--	--	1	μA
		V <sub>DS</sub> = 400 V, T <sub>C</sub> = 125°C	--	--	10	μA
I <sub>GSSF</sub>	Gate-Body Leakage Current, Forward	V <sub>GS</sub> = 30 V, V <sub>DS</sub> = 0 V	--	--	100	nA
I <sub>GSSR</sub>	Gate-Body Leakage Current, Reverse	V <sub>GS</sub> = -30 V, V <sub>DS</sub> = 0 V	--	--	-100	nA

<b>On Characteristics</b>						
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	3.0	--	5.0	V
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 0.55 A	--	6.8	9.0	Ω
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 50 V, I <sub>D</sub> = 0.55 A (Note 4)	--	0.98	--	S

<b>Dynamic Characteristics</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V, f = 1.0 MHz	--	115	150	pF
C <sub>oss</sub>	Output Capacitance		--	20	30	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		--	3.0	4.0	pF

<b>Switching Characteristics</b>						
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 250 V, I <sub>D</sub> = 1.4 A, R <sub>G</sub> = 25 Ω  (Note 4, 5)	--	5	20	ns
t <sub>r</sub>	Turn-On Rise Time		--	25	60	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		--	8	25	ns
t <sub>f</sub>	Turn-Off Fall Time		--	20	50	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 400 V, I <sub>D</sub> = 1.4 A, V <sub>GS</sub> = 10 V  (Note 4, 5)	--	4.0	5.5	nC
Q <sub>gs</sub>	Gate-Source Charge		--	1.1	--	nC
Q <sub>gd</sub>	Gate-Drain Charge		--	2.2	--	nC

<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current	--	--	1.1	A	
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current	--	--	4.4	A	
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 1.1 A	--	--	1.4	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 1.4 A, di <sub>F</sub> / dt = 100 A/μs (Note 4)	--	170	--	ns
Q <sub>rr</sub>	Reverse Recovery Charge		--	0.4	--	μC

**Notes:**

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 120mH, I<sub>AS</sub> = 1.1A, V<sub>DD</sub> = 50V, R<sub>G</sub> = 25 Ω, Starting T<sub>J</sub> = 25°C
3. I<sub>SD</sub> ≤ 1.4A, di/dt ≤ 200A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub> = 25°C
4. Pulse Test : Pulse width ≤ 300μs, Duty cycle ≤ 2%
5. Essentially independent of operating temperature

Typical Characteristics

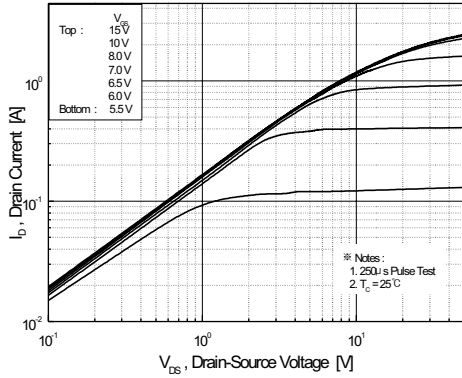


Figure 1. On-Region Characteristics

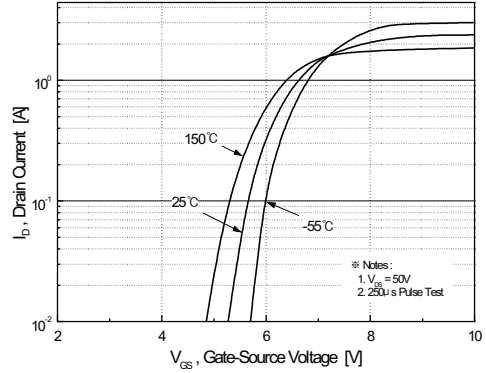


Figure 2. Transfer Characteristics

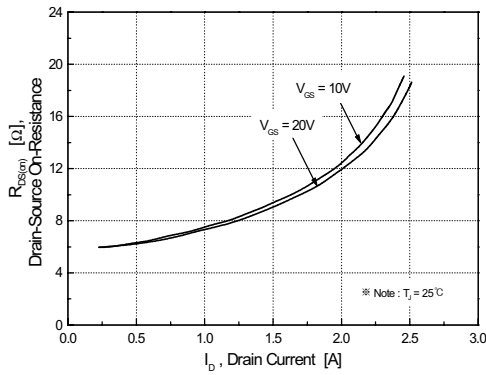


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

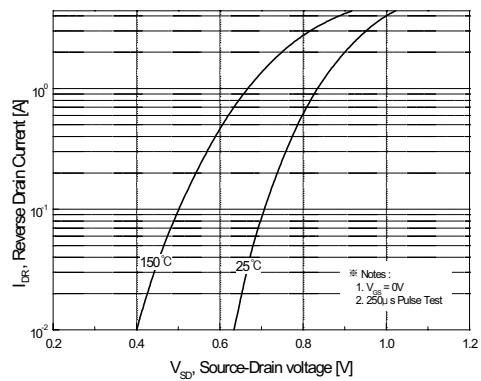


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

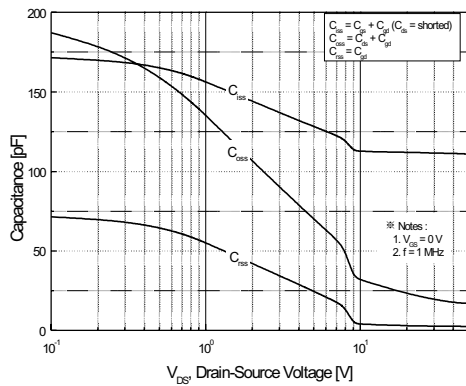


Figure 5. Capacitance Characteristics

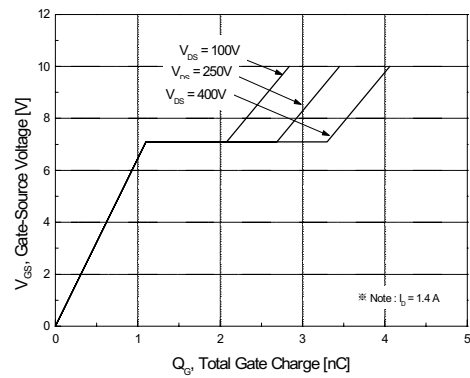
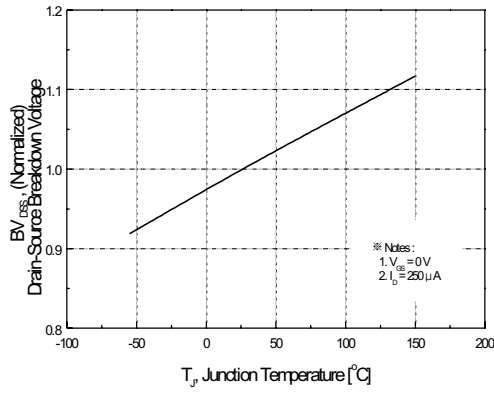
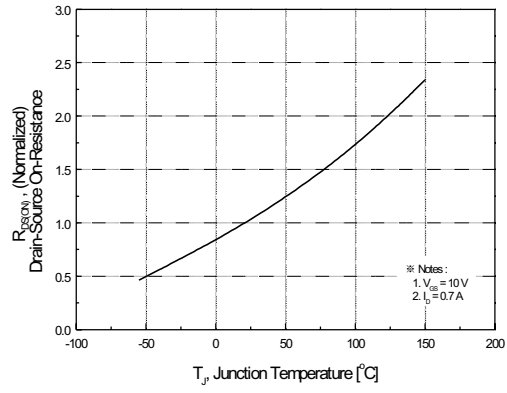


Figure 6. Gate Charge Characteristics

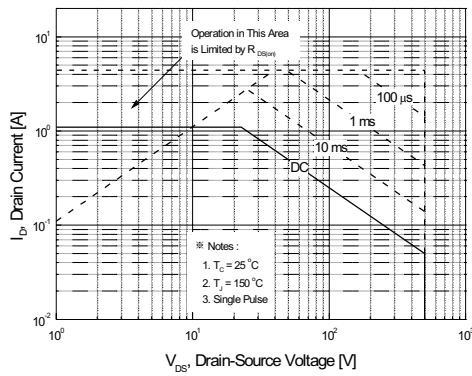
**Typical Characteristics** (Continued)



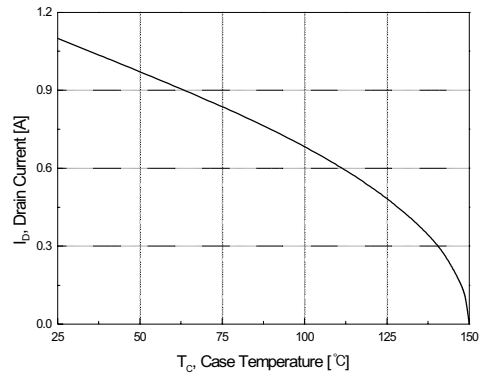
**Figure 7. Breakdown Voltage Variation vs. Temperature**



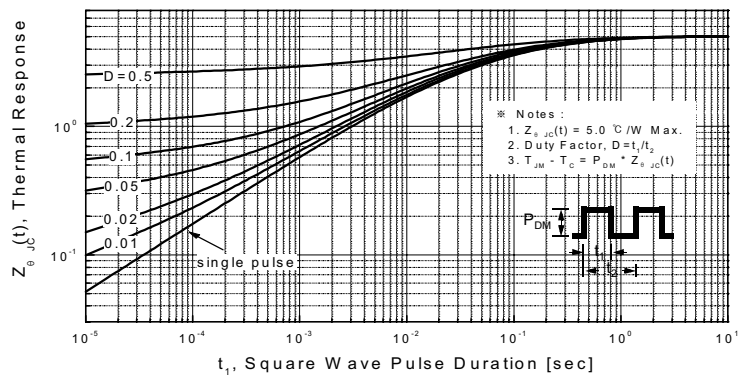
**Figure 8. On-Resistance Variation vs. Temperature**



**Figure 9. Maximum Safe Operating Area**

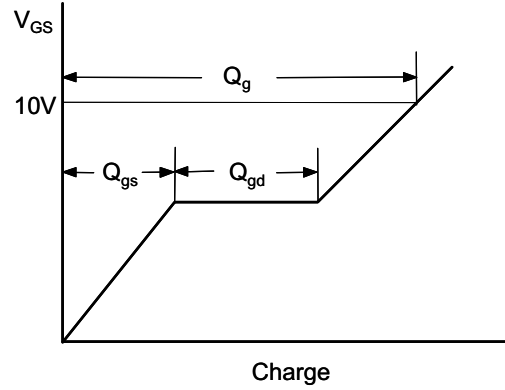
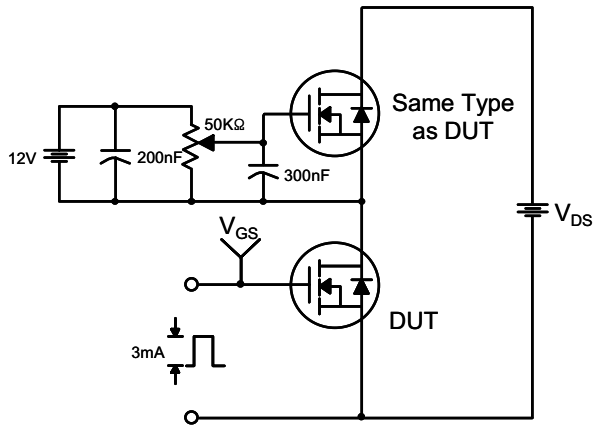


**Figure 10. Maximum Drain Current vs. Case Temperature**

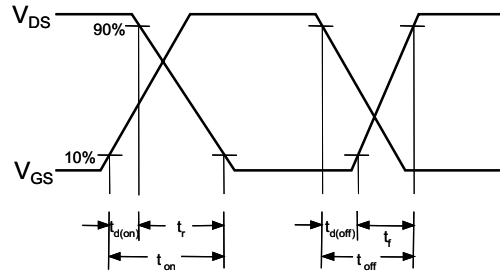
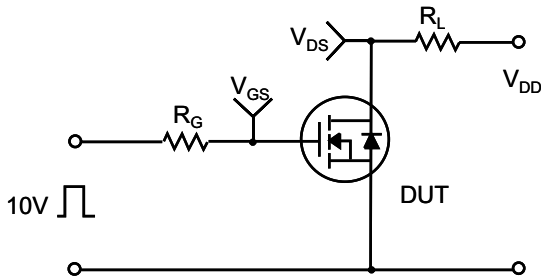


**Figure 11. Transient Thermal Response Curve**

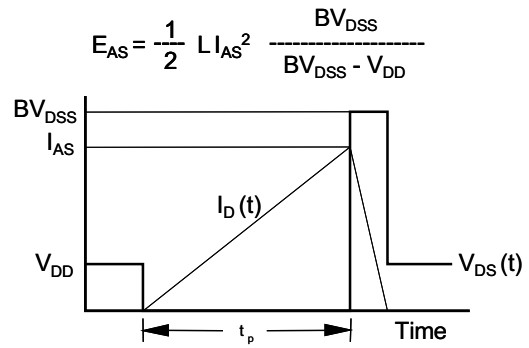
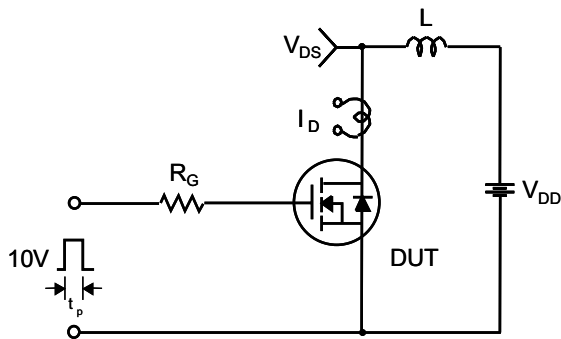
Gate Charge Test Circuit & Waveform



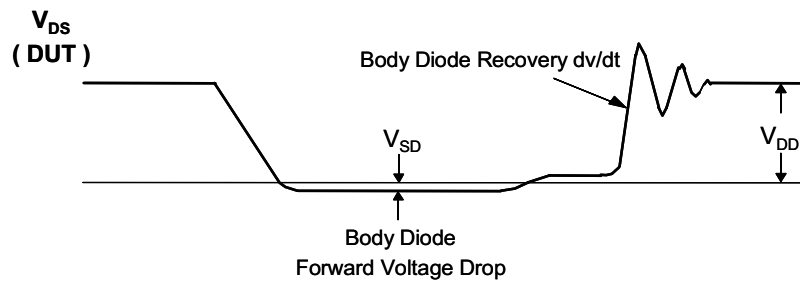
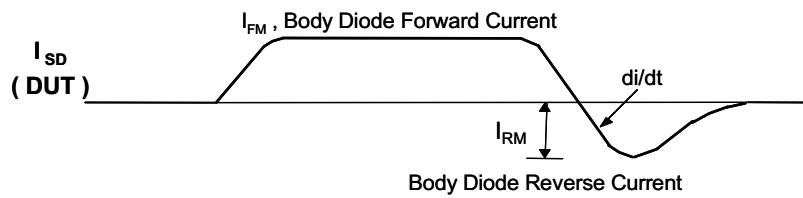
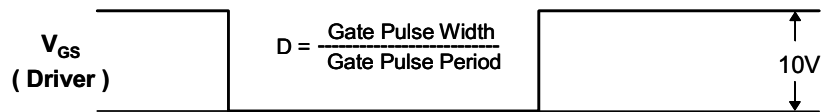
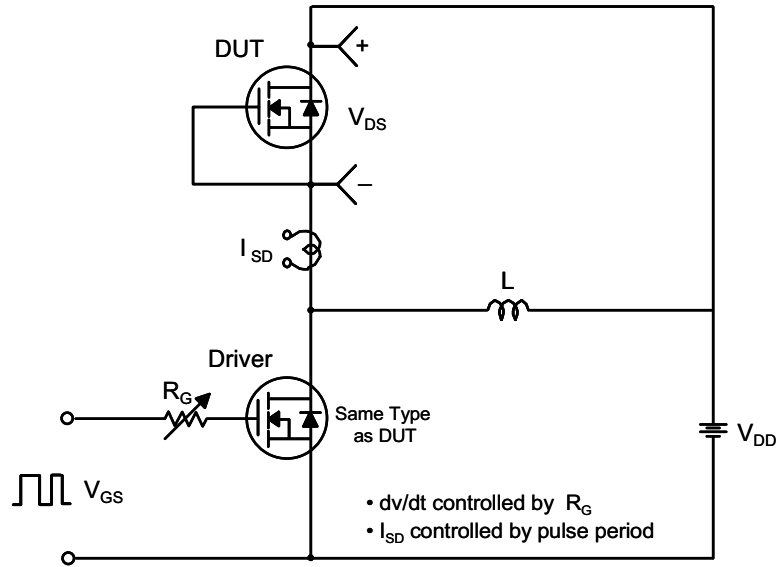
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

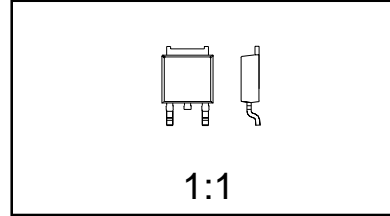
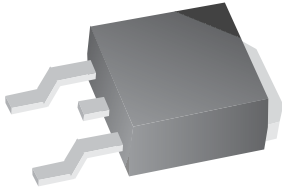


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Package Dimensions

TO-252 (DPAK) (FS PKG Code 36)

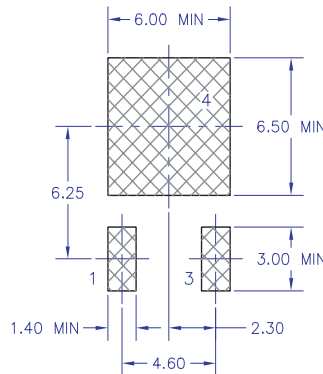
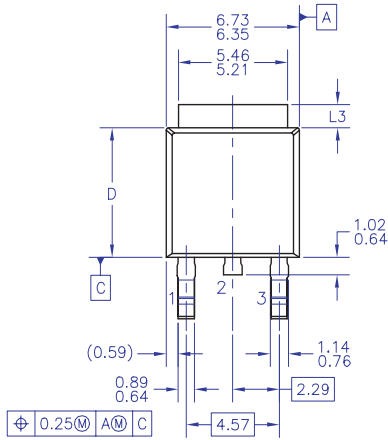


1:1

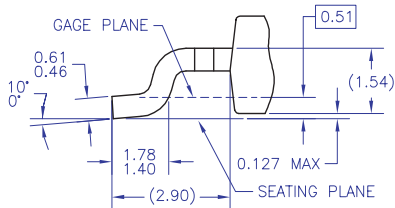
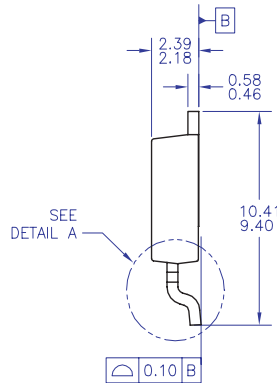
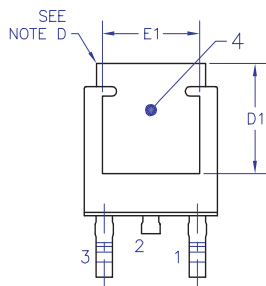
Scale 1:1 on letter size paper

Dimensions shown below are in:  
millimeters

Part Weight per unit (gram): 0.33



LAND PATTERN RECOMMENDATION



DETAIL A  
(ROTATED -90°)  
SCALE: 12X

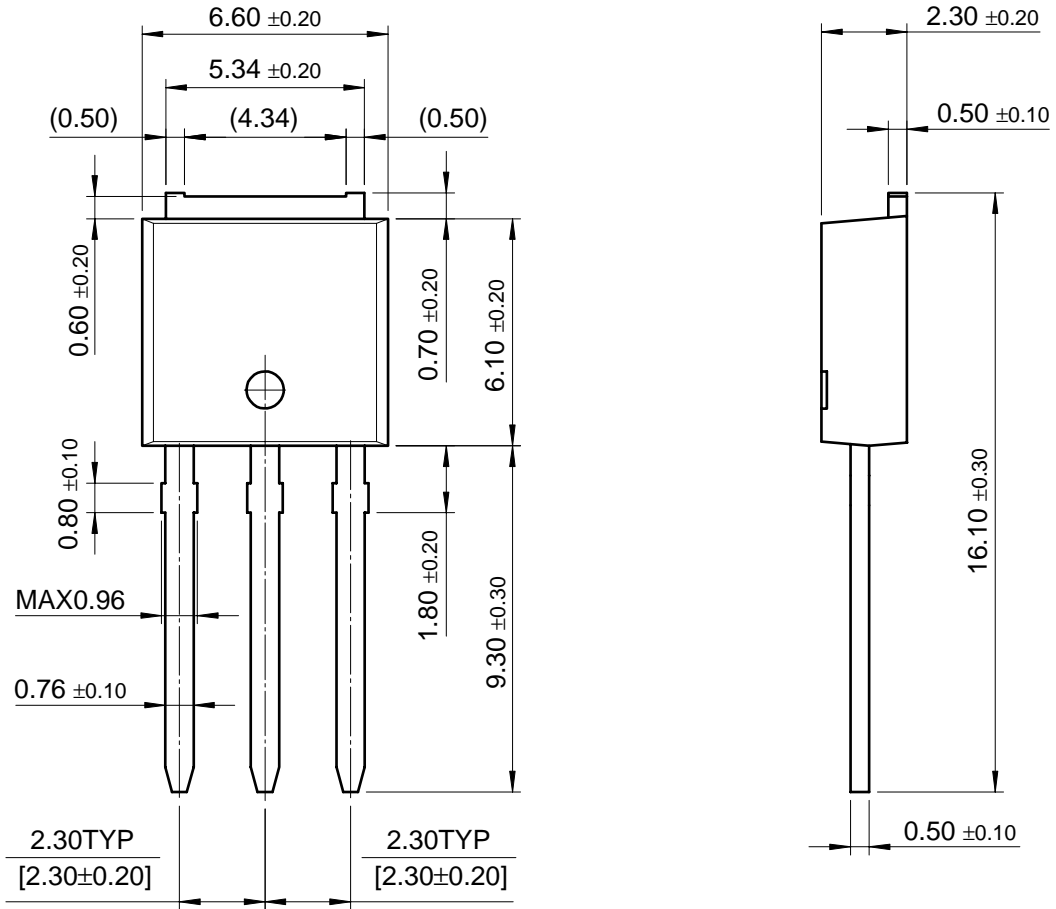
NOTES: UNLESS OTHERWISE SPECIFIED

- A) ALL DIMENSIONS ARE IN MILLIMETERS.
- B) THIS PACKAGE CONFORMS TO JEDEC, TO-252, ISSUE C, VARIATION AA & AB, DATED NOV. 1999.
- C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
- D) HEAT SINK TOP EDGE COULD BE IN CHAMFERED CORNERS OR EDGE PROTRUSION.
- E) DIMENSIONS L3,D,E1&D1 TABLE:

	OPTION AA	OPTION AB
L3	0.89-1.27	1.52-2.03
D	5.97-6.22	5.33-5.59
E1	4.32 MIN	3.81 MIN
D1	5.21 MIN	4.57 MIN

Package Dimensions (Continued)

# IPAK



FQD1N50 / FQU1N50





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2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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